

Justifications for Exemptions from Construction Permitting
567 IAC 22.1(2) “x” through “hh”

x. Exemption for equipment, processes, and activities considered to be “trivial.” The equipment, processes, and activities included in this exemption are the same as, or similar to, the list of activities that are treated as trivial in EPA's 1995 "White Paper for Streamlined Development of Part 70 Permit Applications." Equipment, processes, and activities that have no specific applicable requirements and result in extremely small emissions are considered to be trivial activities. EPA allows trivial activities to be omitted from the insignificant activities list that is federally approved as part of the state's operating permit program. Table 1 summarizes the justification for exempting each of these activities from the requirement to obtain a construction permit. Overall, these activities generate emissions that have no environmental or human health consequences, have never been implicated as causing or contributing to nonattainment of an ambient air quality standard, and in many cases are similar to activities that are already exempted in 567 IAC 22.1(2).

y. Direct-fired fuel burning equipment. The equipment included in this exemption are the same as the equipment included in the current exemptions found in 567 IAC 22.1(2) “a” and “b” except that this exemption will cover additional units that may have emissions other than only the products of combustion. To address this, the exemption requires that emissions other than from the products of combustion must be accounted for in an enforceable permit condition or otherwise be exempted under this subrule. This mechanism allows the emissions other than those from the products of combustion to be evaluated. The emissions from the actual combustion are much less than the thresholds for a small unit exemption in 567 IAC 22.1(2)“w”, which were established using dispersion modeling. Therefore, emissions from the products of combustion in direct fired units with the fuel and heat input limitations specified in the exemption will have no significant environmental or human health consequences.

z. Closed refrigeration systems, including storage tanks used in refrigeration systems, but excluding any combustion equipment associated with such systems. These are closed systems, which under normal operating conditions do not vent to the atmosphere. The exemption is considered an insignificant activity under the Title V program, and is not required to be included in Title V permit applications [567 IAC 22.103(1)“t”].

There is a separate regulatory program that governs air emissions from refrigeration systems. Under Title VI of the Clean Air Act (CAA), EPA's Global Programs Division is responsible for several programs that protect the stratospheric ozone layer. Below is a brief summary of those programs.

- Motor Vehicle Air-Conditioning (Sec. 609 of the CAA): This program regulates on-road car and truck air-conditioning systems, as well as technician certification and service equipment for those systems. The sale of small cans of certain ozone-depleting refrigerants is restricted to technicians certified under this program.

Table 1. Summary of Justification for Exempting Trivial Activities

Equipment, process, or activity	Justification
(1) Cafeterias, kitchens, and other facilities used for preparing food or beverages primarily for consumption at the source.	Past historical department practice has been to exclude these types of facilities from the requirement to obtain an air construction permit. The department does not believe that it is necessary to change this practice at this time.
(2) Consumer use of office equipment and products, not including printers or businesses primarily involved in photographic reproduction.	VOC emissions from copier and printer cartridges are considered to be negligible in the workplace. Emissions will have no environmental or human health consequences.
(3) Janitorial services and consumer use of janitorial products.	Activity is not subject to any requirements under the SIP. Emissions of regulated air pollutants are considered to be negligible. Emissions are generated inside and have no environmental or human health consequences.
(4) Internal combustion engines used for lawn care, landscaping, and grounds-keeping purposes.	Internal combustion engines for mobile sources are already exempted under 22.1(2)"c," including jet engines, marine vessels, and locomotives.
(5) Laundry activities, not including dry-cleaning and steam boilers.	Low emissions that are generated inside and will have no environmental or human health consequences.
(6) Bathroom vent emissions, including toilet vent emissions.	Considered to be in same category as stacks or vents used to prevent the escape of sewer gases through plumbing traps, which are exempted under 22.1(2)"n."
(7) Blacksmith forges.	Generally considered to be in same category as residential wood heaters or fireplaces, which are exempted under 22.1(2)"j." Only small number still in existence and are used infrequently.
(8) Plant maintenance and upkeep activities, and repair or maintenance shop activities (e.g., grounds-keeping, general repairs, cleaning, painting, welding, plumbing, re-tarring roofs, installing insulation, and paving parking lots) provided these activities are not conducted as part of a manufacturing process, are not related to the source's primary business activity, and not otherwise triggering a permit modification. Cleaning and painting activities qualify if they are not subject to VOC or HAP control requirements.	The department has never regulated these types of activities in the past and does not intend to in the future. These are non-production activities, some of which are currently exempted under 22.1(2)"p," "u," and "v," related to maintaining the facility in good repair and working order, which contributes to the proper operation of sources that are part of the production process.
(9) Air compressors and vacuum pumps, including hand tools.	Emissions of regulated air pollutants are considered to be negligible.
(10) Batteries and battery charging stations, except at battery manufacturing plants.	Emissions of regulated air pollutants are considered to be negligible.

Table 1. Summary of Justification for Exempting Trivial Activities (Cont.)

Equipment, process, or activity	Justification
(11) Storage tanks, reservoirs, pumping and handling equipment of any size, and equipment used to mix and package soaps, detergents, surfactants, waxes, glycerin, vegetable oils, greases, animal fats, sweetener, corn syrup, and aqueous salt or caustic solutions, provided appropriate lids and covers are utilized and no organic solvent has been mixed with such materials.	Prohibits use of organic solvents and requires use of lids and covers. Emissions of regulated air pollutants are expected to be negligible.
(12) Equipment used exclusively to slaughter animals, but not including other equipment at slaughterhouses, such as rendering cookers, boilers, heating plants, incinerators, and electrical power generating equipment.	Emissions of regulated air pollutants are considered to be negligible.
(13) Vents from continuous emissions monitors and other analyzers.	Similar to equipment used in laboratories for nonproduction chemical and physical analyses, which are exempted under 22.1(2)"1."
(14) Natural gas pressure regulator vents, excluding venting at oil and gas production facilities.	Emissions are very small and intermittent. Major constituents of natural gas are methane and ethane.
(15) Equipment used for surface coating by brush or roller, painting, and dipping operations, except those that will emit VOC or HAP.	Emissions of regulated air pollutants are considered to be negligible.
(16) Hydraulic and hydrostatic testing equipment.	Similar to equipment used in laboratories for nonproduction chemical and physical analyses, which are exempted under 22.1(2)"1."
(17) Environmental chambers not using HAP gasses.	Similar to equipment used in laboratories for nonproduction chemical and physical analyses, which are exempted under 22.1(2)"1."
(18) Shock chambers and humidity chambers, and solar simulators.	Similar to equipment used in laboratories for nonproduction chemical and physical analyses, which are exempted under 22.1(2)"1."
(19) Fugitive dust emissions related to movement of passenger vehicles on unpaved road surfaces, provided the emissions are not counted for applicability purposes and any fugitive dust control plan or its equivalent is submitted as required by the department.	Fugitive dust emissions are allowed under 23.3(2)"c," provided reasonable precautions are taken to prevent particulate matter in quantities sufficient to create a nuisance from becoming airborne and reasonable precautions are taken to prevent the discharge of visible emissions beyond the facility property line.
(20) Process water filtration systems and demineralizers, demineralized water tanks, and demineralizer vents.	Emissions of regulated air pollutants are considered to be negligible.
(21) Boiler water treatment operations, not including cooling towers.	Emissions of regulated air pollutants are considered to be negligible.
(22) Oxygen scavenging (de-aeration) of water.	Not a source of regulated air pollutants.
(23) Fire suppression systems.	Emergency equipment, not part of normal facility operations.
(24) Emergency road flares.	Emergency equipment, not part of normal facility operations.
(25) Steam vents and safety relief valves, steam leaks.	Not a source of regulated pollutants.
(26) Steam sterilizers.	Emissions of regulated air pollutants are considered to be negligible.

- Stationary Refrigeration and Air-Conditioning, Halon Blends & Handling (Sec. 608 of the CAA): Most air-conditioning and refrigeration appliances not regulated as motor vehicle air-conditioners are regulated under this program. A number of service practice, refrigerant reclamation, technician certification, and other requirements are covered by this program. In addition, halon fire suppression system installation and certain emissions of halons are covered by this program.
- Phase out of Ozone-Depleting Substances (primarily Sec.'s 604 & 606 of the CAA): The ban on the production and import of class I ozone-depleting substances (ODS), including exemptions for certain essential uses, is covered under this program. The phase out of class II substances is also covered.
- Methyl Bromide: Although most affected by the phase out, EPA's work concerning this important soil fumigant encompasses several different programs, and is therefore listed separately.
- Nonessential Products Ban (Sec. 610 of the CAA): Bans the sale of certain products manufactured with, or containing, ozone-depleting substances. This program covers the ban on both class I and class II products.
- Product Labeling (Sec. 611 of the CAA): This program establishes labeling requirements for products that are manufactured with, or that contain, class I ozone-depleting substances. Labeling of products manufactured with, or containing, class II ODS is required no later than 2015.
- Federal Procurement (Sec. 613 of the CAA): Under this program federal entities are required to conform their procurement policies to the stratospheric ozone protection requirements of Title VI.

Since emissions from closed refrigeration systems do not normally vent to the atmosphere and the substances used in closed refrigeration systems are regulated under Title VI of the CAA to protect the stratospheric ozone layer, this exemption will result in no significant environmental or human health consequences.

aa. Aqueous-based pretreatment application processes, including pretreatment processes that use aqueous-based cleaners, cleaner-phosphatizers, and phosphate conversion coating chemistries.

Prior to painting or powder coating, manufacturers of metal fabricated products (ferrous and nonferrous) must prepare the substrate to achieve a desired level of coating performance. The type of pretreatment used varies depending on the degree of coating performance desired (e.g., corrosion resistance and adhesion) and the type of coating applied (e.g., solvent-borne, powder coating, high solids, water-based). Typical high-performance coatings, particularly powder coating, high solids solvent-based liquid coatings and water-borne coatings, are particularly sensitive in regard to good substrate pretreatment.

Process Overview

Pretreatment of metal substrates before coating often involves three key components. These include cleaning, phosphatizing (or chemical etching for nonferrous metals) and rinsing.

Cleaning. Cleaning is the first and most critical step of the pretreatment process. Subsequent pretreatment processes cannot be accomplished unless organic and inorganic soils are removed from the substrate. Heated, water-based alkaline cleaners are most effective at removing organic soils from the substrate. These cleaning chemistries are comprised of alkaline builders, wetting agents or surfactants, and water softeners.

For some applications, an acidic detergent chemistry may be used to pretreat the metal substrate. As described below (see combined cleaner-phosphatizers), this chemistry is used when a facility desires to accomplish cleaning and phosphatizing in a single step.

Rinsing. Rinsing is performed after chemical stages of the pretreatment process. It's used to flush away soils adhering to the substrate surface, remove excess alkalinity from the substrate before phosphatizing, and to stop the phosphatizing reaction. Typically, rinsing is performed with raw water at ambient temperature. For improved performance, dissolved solids may be removed from raw water through a reverse osmosis or deionization system.

Phosphatizing. The phosphatizing process is used to form a conversion coating (iron or zinc phosphate) on ferrous substrates and produce a micro-etch on nonferrous metals. It is the result of an acidic phosphatizing chemical reaction with the metal substrate. The conversion coating produced on steel substrates greatly improves coating adhesion and corrosion resistance. The micro-etching of nonferrous substrates also improves adhesion. In some cases, the phosphatizing process may produce an alloy phosphate conversion coating on nonferrous metals.

Methods of Application

The method by which the water-based pretreatment chemistries are applied to the substrate is dependent on the parts coated and desired pretreatment quality. The most common forms of application include the following:

- Immersion (two-plus stages)
- Hand-held spray wand application (one to four stages)
- Recirculating spray washers (one to five-plus stages)

For each application method, pretreatment chemistries are sold in concentrate form and must be diluted with water before use. The following provides a brief overview of each application method. It includes general information on their operation, chemical concentrations and operating temperatures.

Immersion. Immersion pretreatment systems consist of a tank or series of tanks containing aqueous-based pretreatment solutions. Like other methods of application, the chemical stages (i.e., cleaning, phosphatizing or cleaning-phosphatizing) are typically heated for performance. Immersion tanks may be static or agitated for improved soil removal.

Normal operating temperatures and concentrations associated with immersion systems range from 110 to 170°F and three to five percent (by volume), respectively. Because the process does not atomize the solution, ventilation requirements associated with immersion systems are less than those required for other methods of application.

Spray Wand Application. Spray wand application is a low cost pretreatment method often used on large, heavy, bulky parts that cannot be cleaned on conveyorized finishing systems. Spray wands typically operate at four to five gallons-per-minute (gpm), 1,000-1,500 psi and 160-200°F. Cleaning and phosphatizing chemical solutions are typically applied at concentrations of 0.5 to one percent by volume. Attachment B includes product information for pretreatment chemicals formulated for spray wand application. Spray wand pretreatment may consist of one to four stages. For example, a single stage spray wand process typically consists of applying a no-rinse cleaner-phosphatizer product while a four stage pretreatment process consists of an alkaline cleaner (heated) followed by a rinse, an iron-phosphatizing stage (heated) and a final rinse.

Spray wand application of pretreatment solutions often takes place in a well-vented area to remove steam, humidity and protect the operator. . This may be accomplished with simple building ventilations systems (e.g., a wall fan) or more elaborate system such as a wash booth with an outside exhaust system.

Recirculating Washers. Recirculating spray washers are a popular method of application for high capacity, conveyorized production lines. These systems consist of a series of stages equipped with a reservoir, transfer pump, risers and spray nozzles. Pumps transfer the reservoir solution to a set of risers inside the washer canopy. Risers are fitted with numerous spray nozzles that spray the solution onto the parts – typically at pressures of 10 to 30 psi. Figures aa-1 and aa-2 illustrate the configuration of a three and five stage washer.

Spray washers with three or fewer stages typically utilize a combined cleaner-phosphatizer product as the first stage chemistry. This stage may be followed by one or more rinse stages. The chemical stage is typically heated to a temperature of 90 to 140°F, contains 1.5 to 3.0 percent chemical concentrate (by volume), and is maintained at a pH of 3.0 to 5.5.

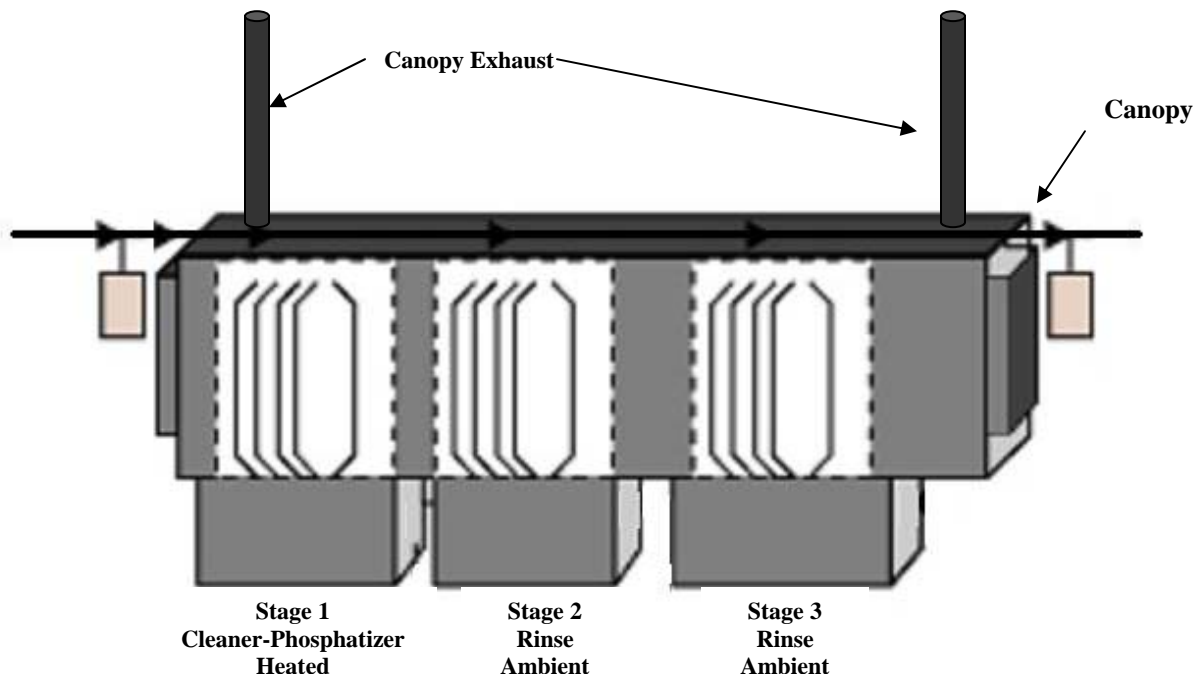


Figure aa-1. Three stage recirculating spray washer – typical configuration.

Recirculating spray washers with 4 or more stages are typically used when higher coating performance requirements are needed. These systems typically use a pretreatment chemistry specifically for cleaning (i.e., a heated alkaline cleaning solution in the first stage) followed by a rinse stage. The third stage typically uses a pretreatment chemical specifically for phosphatizing. This is also followed by a rinse. Since this system uses separate chemical solutions devoted solely to a specific purpose (i.e., cleaning or phosphatizing – not both), parts generally achieve a higher degree of pretreatment.

Chemical stages in these systems are typically heated to temperatures of 90 to 140°F and the chemical concentrate used to make up the solution in each chemical stage varies from two to four percent (by volume). To remove the heat, humidity and to keep solution mists from escaping out the ends of the washer (i.e., the conveyor openings), exhaust fans draw air through the conveyor openings, exhausting heat and steam outside.

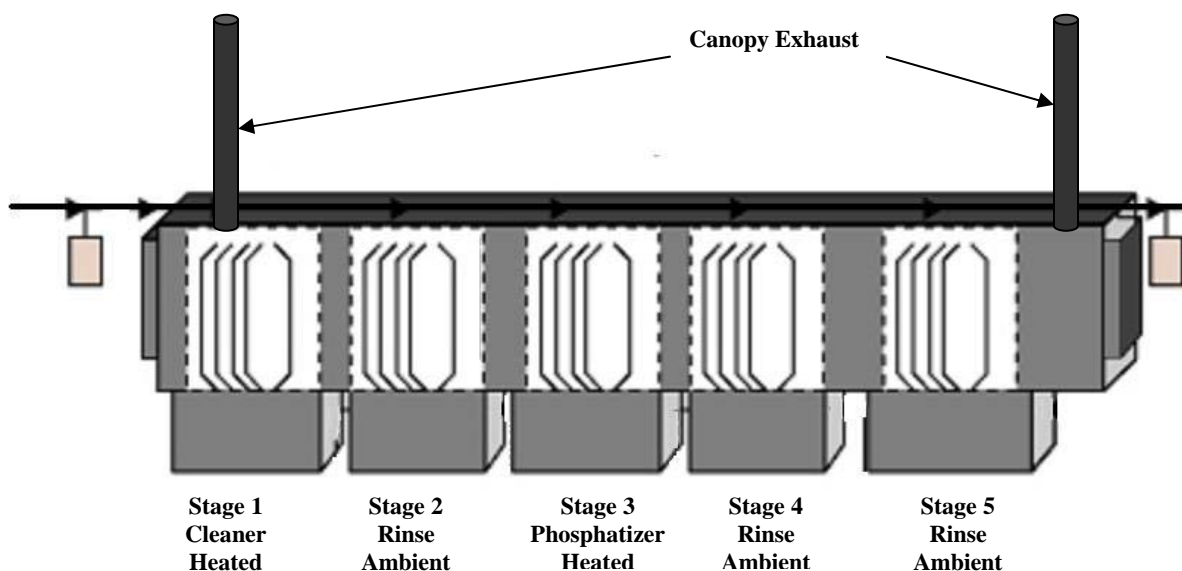


Figure aa-2. Five stage recirculating spray washer – typical configuration.

Rationale for Exemption

VOC and HAP Emission Concerns. As indicated in product data sheets and MSDS information, most water-based pretreatment chemistries used to prepare parts for an organic coating contain very little, if any, VOCs and HAPs in their formulation. Table aa-1 summarizes the VOC and HAP information obtained for a variety of aqueous pretreatment products. Additionally, as indicated in product data sheets and Table aa-1, pretreatment chemical concentrates are highly diluted before use (chemical concentrates are typically used at five percent or less [by volume] for application).

TABLE aa-1

Product VOC and HAP Summary Information

Product Description	Concentrate VOC / HAP Content ^a	Suggested Application Concentration ^b
Fremont Industries 626TP Cleaner-Phosphatizer	0% / 0%	0.5% - 2%
Fremont Industries 752 Cleaner	0% / 0%	1% - 5%
Fremont Industries 758 Iron Phosphate Conversion Coating	0% / 0%	2% - 4%
Fremont Industries 745 Non-chromate Sealing Compound	0% / 0%	0.25% - 0.50%
Oakite Cryscat 187	<5% / 5%	3% - 5%
Oakite Cryscat 2100SC	<5% / <5%	0.5% - 1%
Oakite Cryscat 2147	<5% / 5%	2% - 3%
KCI Chemical Company Liqua Phos 6202	0% / 0%	Not Specified
Hotsy BREAKTHROUGH!	10% / 5%	Not Determined

^a – By weight as indicated in MSDS and product data information.

^b – By volume as indicated in the product data sheet.

Assuming any VOCs and HAPs contained in the pretreatment product are emitted to the atmosphere in their entirety (i.e., a worst-case scenario), a significant amount of concentrate would need to be consumed by the pretreatment process in order to exceed substantial small unit (SSU) thresholds for VOCs and HAPs (as specified by IAC Chapter 22.1(2)“w”). The following calculation illustrates the gallons of concentrate that would need to be consumed in a pretreatment process in order to reach the SSU threshold for VOCs and HAPs (3.75 tons/yr). It assumes that the VOC/HAP content of the concentrate is 5 percent (by weight) and the density of the concentrate is 10.1 lbs/gal.

$$\frac{3.75 \text{ tons/yr} \times 2,000 \text{ lbs/ton}}{10.1 \text{ lbs/gal}(\text{concentrate density}) \times 0.05(\text{VOC/HAP content})} = 14,851 \text{ gallons of concentrate}$$

As illustrated above, a significant volume of chemical concentrate would need to be consumed in order to exceed the SSU threshold established for VOCs and HAPs.

Particulate Emission Concerns. Assuming chemical concentrates contain up to one percent total solids (by weight) and these solids are emitted to the atmosphere in their entirety (i.e., a worst-case scenario), a significant amount of concentrate would need to be consumed in the pretreatment process in order to exceed the substantial small unit (SSU) threshold for PM₁₀ (as specified in 567 IAC 22.1(2)“w”). The following calculation illustrates the gallons of concentrate that would need to be consumed in a pretreatment process in order to reach the SSU threshold for PM₁₀ (1.875 tons/yr).

$$\frac{1.875 \text{ tons/yr} \times 2,000 \text{ lbs/ton}}{10.1 \text{ lbs/gal}(\text{concentrate density}) \times 0.01(\text{solids content})} = 37,129 \text{ gallons of concentrate}$$

bb. Powder coating operations.

Powder coating is popular finishing technology used to apply a decorative and/or functional organic film to a variety of products used by industry and consumers. The technology offers the following economic, environmental, health & safety, and performance benefits over liquid coating:

- Powder is immediately ready for use. Powder coating is applied in a dry form (powder coating consists of finely ground particles of pigment, resin and additives). This avoids many of the variables associated with the preparation and application of liquid coatings.
- No solvents. Unlike liquid coatings, powder coating does not contain solvents. In addition, no solvents are used in the application process or for equipment cleaning. Consequently, no volatile organic compounds (VOCs) or Hazardous Air Pollutants (HAPs) are emitted during application and maintenance of application equipment.
- Reduced fire risk. Again, because no solvents are used, powder coating presents benefits in regard to regulatory health & safety concerns and insurance premiums.

- Reduced operator health risks and exposure. Although respirable particulates remain a concern with powder coating, it removes many of the health and safety concerns common to liquid coatings (e.g., inhalation of solvent vapor, respirable particulates, dermal exposure to solvents, and greatly reduced risk of fire).
- Ease of application, high utilization potential, and easy housekeeping. Because powder coating is easy to apply, facilities realize fewer finishing defects and less rework. This equates to reduced waste and pollution prevention. Powder coating overspray can also be collected, reclaimed and reused to achieve utilization efficiencies in excess of 95 percent. Additionally, equipment and application areas are easily cleaned using simple cleaning tools (e.g., compressed air, squeegee, broom or vacuum).

As a result, it's the fastest-growing finishing technology in North America, representing over 10% of all industrial finishing applications¹.

Process Overview

Powder used for the process consists of finely ground particles comprised of thermoplastic (e.g., nylon, PVC, polypropylene, polyethylene) or thermoset (epoxy, acrylic, polyester, hybrid and polyurethane) coating materials. Upon heating, thermoplastic powders melt and flow onto the substrate while retaining their original chemical composition. Thermoset powders, however, simultaneously melt, flow, and polymerize through a cross-linking chemical reaction to form a high molecular weight decorative/protective film.

For electrostatic spray application, most commercial powders are manufactured with a particle size between 10 and 100 microns². Deviating from this particle size range may result in poor electrostatic deposition, appearance problems, and poor coating performance. Figure bb-1 illustrates a typical particle size distribution for a pigmented epoxy coating.

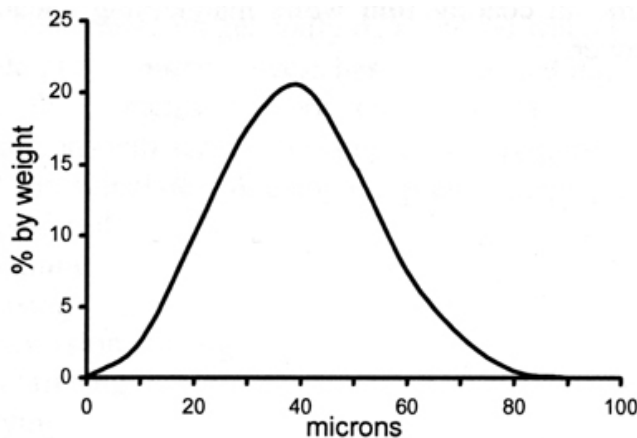


Figure bb-1. Typical particle size distribution for a pigmented epoxy powder.

Application Equipment. Powder coatings are typically sprayed onto the substrate or applied using a fluidized bed. The electrostatic spray process, however, is most common application method because it's more versatile, efficient, and provides better control. Spray application is *typically* an electrostatic process where powder is pneumatically conveyed to a powder coating spray gun (automatic or manually operated). The powder particles are then charged by the spray gun through corona or tribo charging. Charged powder particles are then sprayed toward a grounded, conductive work piece. The charged particles are electrostatically attracted to the work piece, causing them to deposit and adhere to the substrate in a relatively efficient manner.

Powder coating may also be sprayed onto a pre-heated substrate with or without the use of electrostatics. As powder particles come into contact with the heated substrate they fuse to the surface. This method of application is often used on low or non-conductive substrates such as glass, ceramics, or medium density fiberboard. It's also used when high film builds are required.

Like spray application, fluidized bed operations can use electrostatic charging or pre-heated parts for powder deposition onto the substrate. Powder is loaded into a container equipped with a porous plate above an air plenum chamber. Compressed air is then supplied to the air plenum where it percolates through the porous plate and fluidizes the powder (i.e., it causes the powder to behave more like a fluid). Objects to be coated are passed through the fluidized powder (for powder deposition) and then proceed to the cure oven.

Powder Spray Booth. Powder spray booths are used to contain and collect overspray from a powder coating spray process. Spray booths are designed to protect the operator (by drawing overspray away) and prevent powder from reaching potentially explosive concentrations in the booth. Typically, powder booths are equipped with highly efficient cartridge, cyclone or combination cartridge-cyclone collection systems to separate powder from air. Figures bb-2 and bb-3 illustrate the types of powder coating spray booths often found at powder coating facilities. As most powder coating booths recirculate air back into the plant (rather than exhausting outdoors), systems are specifically designed to ensure the air returned to the plant is as clean as possible. As shown in Figure bb-2, powder-laden air is drawn through the booth to one or more cartridge filters (i.e., the primary filters). Cartridges are typically constructed of cellulose or synthetic (typically polyester) filter media to separate powder from air. Cartridge filters used for this application typically have removal efficiencies in excess of 99.99%.

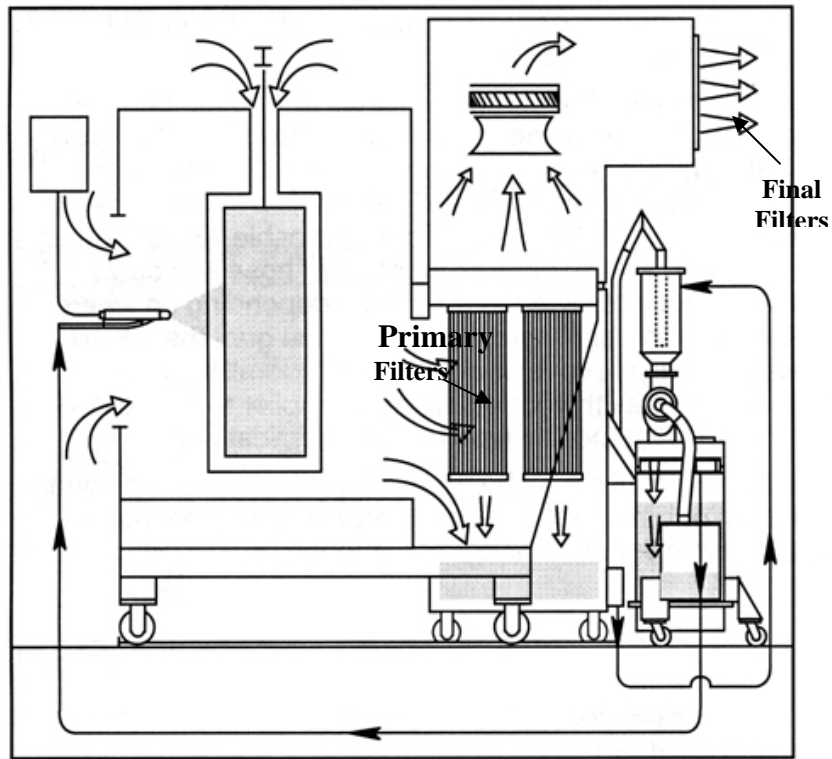


Figure bb-2. Schematic diagram of air flow through a cartridge system powder booth.

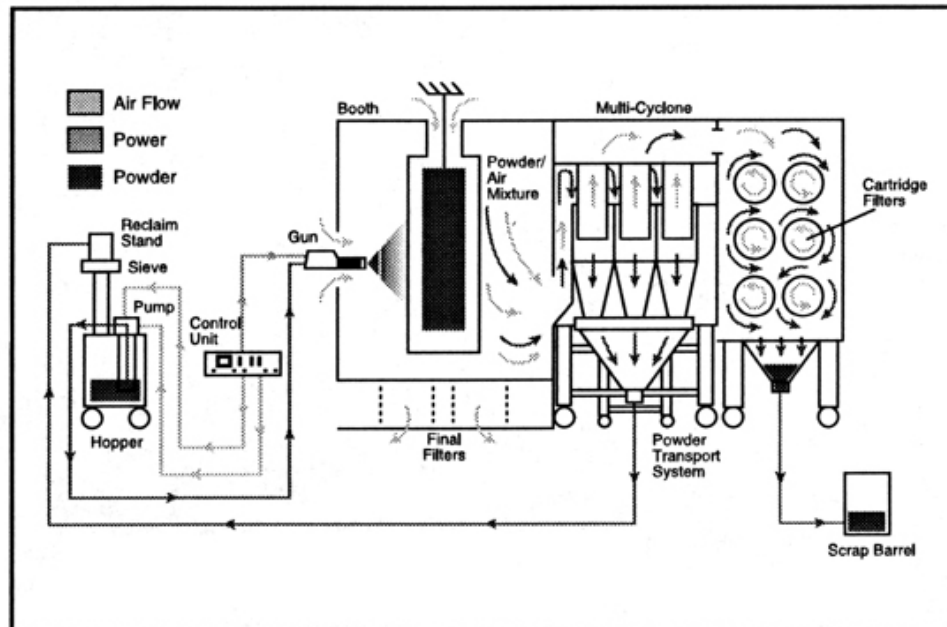


Figure bb-3. Schematic diagram of air flow through a powder booth equipped with a combination cyclone-cartridge system.

Air passing through the primary filters is then routed to a final filtration stage (see Figure bb-2). Documentation obtained on the efficiency of these final filters indicates they are 95% efficient with respect to 0.3 micron particles (based on dioctylphthalate [D.O.P.] aerosol testing. In addition, based on ASHRAE Standard 52-76 test procedures using AC Fine Test Dust^a, these final filters will capture 100% of the powder fed to them.

Curing. The final step of the finishing process consists of routing the coated substrate through a cure oven. Typically, powder coated substrates are processed at a temperature range of 350 to 400°F. However, the availability of low-temperature cure powder coatings (e.g., 180 to 250 °F) is increasing. Low temperature powders are growing in popularity because of the associated energy savings and potential use on heat-sensitive substrates.

Under these part temperatures, the powder coating melts, flows, and (if a thermoset powder) undergoes a cross linking chemical reaction. Negligible, if any, of VOCs are emitted into the atmosphere during cure. However, during the cross-linking reaction of thermoset powders, emissions may be on the order of one percent (three to five percent in the case of polyurethanes) of the total weight of powder coating adhering to the substrate. Other than polyurethanes, the majority of these emissions consist of water desorbed from the powder or formed by chemical reaction.

Curing VOC threshold = $3.75 \text{ tons/yr} \times 2,000 \text{ lbs/ton} = 7,500 \text{ lbs/yr}$

Worst-case assumption: *VOC and HAP emissions from the curing process are 5% (by weight) of the powder coating weight applied to a substrate undergoing curing.*

Amount of powder that would need to undergo curing before reaching the 7,500 lb/yr threshold: $7,500 \text{ lbs}/0.05 = 150,000 \text{ lbs of powder cured per year} = 75 \text{ tons/yr}$

Consequently, a facility that applies less than 75 tons of powder per year would remain below the 3.75 tons/year VOC threshold. Powder purchase, storage, and disposal records could be used to document compliance. If tracking waste powder coating is deemed impractical, businesses may assume that 100% of the powder purchased is applied to the parts being finished (i.e. 100% application efficiency – [again, a worst-case scenario in regard to emissions given off during the cure process as most powder coating operations are well below 100% in application efficiency even if the powder is reclaimed]).

Exemption wording will reflect the 75 ton/yr threshold on cured powder.

Rationale for Exemption

As environmental regulations should promote environmentally-friendly technologies through reduced regulatory burden, it is proposed that powder coating operations performed using generally accepted industry practices and equipment be exempt from air construction permitting. Based on information presented above, powder coating offers significant environmental and safety benefits over more traditional liquid spray finishing processes. Additionally, the environmental impact of powder coating is negligible when

applied and processed under generally accepted industry practices. Therefore, in order to promote powder coating as an environmentally-preferred surface coating technology and acknowledge its environmental benefit, powder coating operations using industry-accepted practices and equipment should be exempt.

References

1 Powder Coating Institute (www.powdercoating.org).

2 Interpon Powder Coatings (November 1999) *Complete Guide to Powder Coatings*. 34pp.

^a – AC Fine Dust Test consists of: 39% of 0 to 5 micron particles; 18% of 5 to 10 micron particles; 16% of 10 to 20 micron particles; 18% of 20 to 40 micron particles; and 9% of 40 to 80 micron particles.

cc. Production painting, adhesive or coating units. The exemption applies to surface coating units/lines that are not subject to an NSPS or NESHAP and use application systems other than spray systems, making VOC the only criteria pollutant of concern for these operations.

Using a typical VOC content of 7 lbs VOC/gal (typical for many pure solvents), emissions of VOCs equal:

$$1000 \text{ gal/yr} \times 7 \text{ lbs VOC/gal} \times 1 \text{ ton}/2000 \text{ lbs} = 3.5 \text{ tons/yr}$$

The VOC emissions are at or below the 3.75 TPY threshold for substantial small units (567 IAC 22.1(2)“w”). Annual VOC emissions will be less than the small unit threshold by limiting solvent/coating usage to no more than 1000 gallons/year in the exemption.

dd. Production surface coating activity that uses only non-refillable hand held aerosol cans, where the total volatile organic compound emissions from all these activities at a stationary source do not exceed 5.0 tons per year. Hand held surface coating can occur in several locations in a facility making it difficult to employ traditional pollution control equipment. Tracking exact usage for each location can also be problematic. This exemption allows VOC emissions to be tracked facility-wide by using MSDS sheets and assuming all VOCs in a can are emitted. These cans are typically 50% or more VOC, the rest solids or non-VOC liquids. Allowing for transfer efficiency of the solids, the particulate emissions are expected to be approximately 2.0 tons per year at maximum use. This level of emissions is less than the 5 tons per year allowed under the small unit exemption (567 IAC 22.1(2)“w”). This limit equates to approximately 9000 cans per year, which is an unrealistic usage rate.

ee. Production welding.

Two new exemptions are included for production welding. The first exemption is for certain types of welding operations that use a consumable welding electrode (also identified as welding wire or rod). The second exemption is for certain types of welding operations that do not use a consumable welding electrode. The second exemption will

also be for submerged arc welding, which is a type of welding that does use a consumable electrode but which has very low emissions.

Exemption for arc welding using consumable electrodes

The information contained in AP-42, Section 12.19 on Electric Arc welding was the primary basis for the proposed exemption.

Table 12.19-1 provides emissions data for four types of welding that use consumable electrodes: Shielded Metal Arc Welding (SMAW), Gas Metal Arc Welding (GMAW), Flux Cored Arc Welding (FCAW) and Submerged Arc Welding (SAW). The PM₁₀ emission factor for SAW was very low compared to the emission factors for the other welding categories. Based on the emission factor for SAW (0.05 lb/1000 lb electrode consumed), a welding operation would have to consume 20 million pounds of electrode to emit 0.5 ton of PM₁₀. It was determined that this type of welding was an inherently low source of emissions and could be grouped with the non-consumable electrode welding.

For each of the remaining welding types, Table 12.19-1 lists several electrode types that are used in each welding category. PM₁₀ and HAP emissions vary for different electrode types. It was determined that the exemption for GMAW and FCAW should only be for welding that is done on carbon steel; and the exemption for SMAW should be for welding that is done on carbon steel and low-alloy steel.

For GMAW, the exempted welding must use electrodes that meet the American Welding Society A5.18/A.5.18M specification (Carbon Steel electrodes). By definition, this represents the following electrode type from Table 12.19-1: E70S. The PM₁₀ emission factor for this electrode is 5.2 lbs/1000 lb electrode consumed – A rated. GMAW welding using other electrode types would not be exempt.

For SMAW, the exempted welding must use electrodes that meet the American Welding Society A5.1 or A.5.5 specification (Carbon Steel and Low-Alloy steel electrodes). This represents the following electrode types from Table 12.19-1: E11018, E6010, E6011, E6012, E6012, E6013, E7018, E7024, and E7028. The highest PM₁₀ emission factor for these electrodes is 38.4 lbs/1000 lb electrode consumed for E6011 – C rated. SMAW welding using other electrode types would not be exempt.

For FCAW, the exempted welding must use electrodes that meet the American Welding Society A5.20 (Carbon Steel electrodes). This represents the following electrode types from Table 12.19-1: E70T and E71T. The highest PM₁₀ emission factor for these electrodes is 15.1 lbs/1000 lb electrode consumed for E70T – B rated. FCAW welding using other electrode types would not be exempt.

It should also be pointed out that the electrodes covered by the exemption also have lower emissions of HAP metal compared to the electrodes that are used for alloy steel. For example, under the proposed exemption, maximum potential manganese emissions

would be 2.76 lbs per year from the SMAW/FCAW category, maximum chromium emissions would be 0.364 lb per year from the SMAW/FCAW category and 63.6 lbs of manganese per year from the GMAW category.

It was determined that for the purposes of the limitations in the exemption, the SMAW and the FCAW categories should be grouped together.

Based on dispersion modeling using SCREEN3, the maximum amount of consumable welding electrode was determined. (See separate discussion below on the modeling analysis,)

It was determined that 0.18 lb PM₁₀ represented the maximum emission rate that could be allowed for any welding source, given any combination of stack parameters, at the minimum separation distance between the welding source and nearest receptor. (See Table ee-3 below) At 8760 hours of operation per year, this is equal to 1577 lbs of PM₁₀ emissions per year. As can be seen from Table ee-3, as the distance between the welding source and the nearest receptor increases, the maximum allowable emission rate also increases.

It was determined that the exemption would limit the annual amount of welding electrode in order to limit the welding sources' potential to emit below the emission rates that would cause a modeling exceedance, The AP-42 emission factors for GMAW welding (5.2 lbs/1000 lbs electrode) and for SMAW welding (38.4 lbs/1000 electrode) were multiplied by a factor of 1.25. The resulting emission factors of 6.5 and 48 were then used to determine the maximum amount of electrode that could be used for all welders of particular type:

1. $1577 \text{ lbs PM}_{10} / 6.5 \text{ lbs PM}_{10} / 1000 \text{ lbs electrode} = 242, 615 \text{ lbs electrode (GMAW)}$
2. $1577 \text{ lbs PM}_{10} / 48 \text{ lbs PM}_{10} / 1000 \text{ lbs electrode} = 32, 854 \text{ lbs electrode (SMAW)}$

These annual electrode usage amounts were then adjusted down to 200,000 lbs per year for GMAW and 28,000 lbs per year for SMAW/FCAW.

For facilities where the welding sources are a relatively long distance away from the property line, an equation was developed that allows those facilities to use a greater amount of consumable electrode. Development of the equations is discussed in detail below. These equations are only beneficial for facilities whose property line is at least 50 meters (164 feet) away from the nearest welding unit.

To summarize the proposed exemption for welding that uses a consumable electrode:

1. The exemption applies to a facility that uses electrodes for carbon steel and low alloy steel in the GMAW, SMAW, and FCAW welding categories. If a facility uses other types of consumable electrodes, it would not be exempt.

2. Facility wide limits on the amount of electrodes are established for GMAW and SMAW/FCAW. These are annual limits. These usage limits are based on a dispersion modeling evaluation which shows that the emissions will not cause a predicted exceedance of the PM₁₀ NAAQS.
3. A facility can employ an equation which allows it to use more electrodes provided the distance from the welding sources to the property line is greater than 164 feet.

Exemption for welding using a non-consumable electrode, resistance welding, and submerged arc welding

The information contained in AP-42, Section 12.19 on Electric Arc welding and the AP-42 Background Report entitled Development of Particulate and Hazardous Emission Factors for Electric Arc Welding were the primary basis for the proposed exemption.

The background report on page 2-23 states that “Only electric arc welding generates pollutants in quantities of major concern. Resistance welding using certain materials also may generate hazardous pollutants. Due to the lower temperatures of the other welding processes, fewer fumes are released.”

EPA does not have in AP-42 any emissions data on resistance welding or arc welding that does not use a consumable electrode. As stated above, the emission factor given for submerged arc welding shows a very low generation of PM₁₀ emissions.

The proposed second exemption would exempt all resistance welding, arc welding that does not use a consumable electrode and submerged arc welding when these operations are joining base metals that do not include stainless steel, alloys of lead, alloys of arsenic or beryllium and steel that has been surfaced coated (e.g. painted or plastic coated). Base metal coated with a lubricant is not considered a “coated” metal.

Resistance welding – Per the AP-42 Background Report, “In resistance welding, pieces of metal are pressed together while an electric current is passed through them. At this contact point, the resistance is sufficient to increase the temperature and melt the base metals.” (p 2-20) Butt welding, spot welding and seam welding are all examples of resistance welding. Melting of the base metal does occur, but only a small amount of metal is actually melted. There are no emission factors given in AP-42 for resistance welding; emissions are assumed to be lower than the emissions from arc welding using a consumable electrode.

Arc welding that does not use a consumable electrode – Per AP-42, this would include Gas Tungsten Arc Welding and Plasma Arc Welding. TIG welding is a type of Gas Tungsten Arc welding. Per the AP-42 Background Report “Another positive attribute of GTAW is the very low fume formation rate (FFR). The filler wire is fed and melted into the weld pool allowing a lower FFR. This procedure is different from other processes that require the fill material to pass through the arc.” (p 2-5). Plasma Arc welding also makes use of a nonconsumable electrode. There are no emission factors given in AP-42 for arc welding that does not use a consumable electrode; however, emissions are assumed to be lower than the emissions from arc welding using a consumable electrode.

Submerged Arc welding

As stated above, the PM₁₀ emission factor for SAW listed in AP-42 is very low compared to the emission factors for the other welding categories. Based on the emission factor for SAW (0.05 lb/1000 lb electrode consumed), a welding operation would have to consume 20 million pounds of electrode to emit 0.5 ton of PM₁₀. It was determined that this type of welding was an inherently low source of emissions and could be grouped with the non-consumable electrode welding.

To summarize the proposed second exemption for welding:

1. All resistance welding, submerged arc welding and arc welding that does not use a consumable electrode are exempt from permitting provided the base metal is not stainless steel, a lead alloy, an alloy of beryllium, an alloy of arsenic or surface coated.
2. Spot welding, butt welding, and seam welding are all types of resistance welding and are covered by the exemption.

EXECUTIVE SUMMARY – Dispersion Modeling

Modeling was conducted in support of an exemption for welding operations. The modeling utilized the EPA screening model SCREEN3, and considered the worse case conditions for welding units. Using the maximum predicted concentration, an annual electrode usage threshold was derived under which all welders at a facility would be exempted. These thresholds are 28,000 pounds of electrode per year for Shielded Metal Arc Welding (SMAW) and Flux Core Arc Welding (FCAW), and 200,000 pounds of electrode per year for Gas Metal Arc Welding (GMAW). For facilities that utilize more than these thresholds, two equations were developed which calculate the allowable annual electrode usage based on the minimum distance to the property line.

Model Selection and Inputs

EPA's screening model, SCREEN3, was used for this analysis. The SCREEN3 model provides a conservative estimate of concentrations resulting from source emissions, and removes much of the variability present in more refined models such as ISC or AERMOD.

The welding emissions were characterized with a single point source with the parameters shown in Table ee-1 below.

Table ee-1. Source Parameters.

Parameter	Value
Emission Rate (lb/hr)	1.00
Stack Height (feet)	Varied*
Stack Diameter (feet)	1.00
Exit Velocity (fps)	0.00
Stack Gas Temperature (F)	70
Ambient Temperature (F)	70
Receptor Height (feet)	0.00
Urban/Rural Option	Rural
Building Height (feet)	20.00
Minimum Horizontal Building Dimension (feet)	50.00
Maximum Horizontal Building Dimension (feet)	50.00

* Stack height was varied in one-foot increments from 0 to 50 feet.

The emission rate of 1 lb/hr that was used in the modeling is a nominal value that is adjusted later in the analysis to an acceptable level. This was done to minimize the number of model runs that would be required.

In order to account for the effects of building downwash, a typical building was input into the model, and multiple stack heights were run in order to determine the worse case concentration. A building 50 feet by 50 feet and 20 feet tall was used because the relatively small size will provide a conservative estimate of the cavity concentration, and is also a realistic size building for a typical facility. The stack height was varied from ground level up to GEP stack height (50 feet in this case) in one-foot increments.

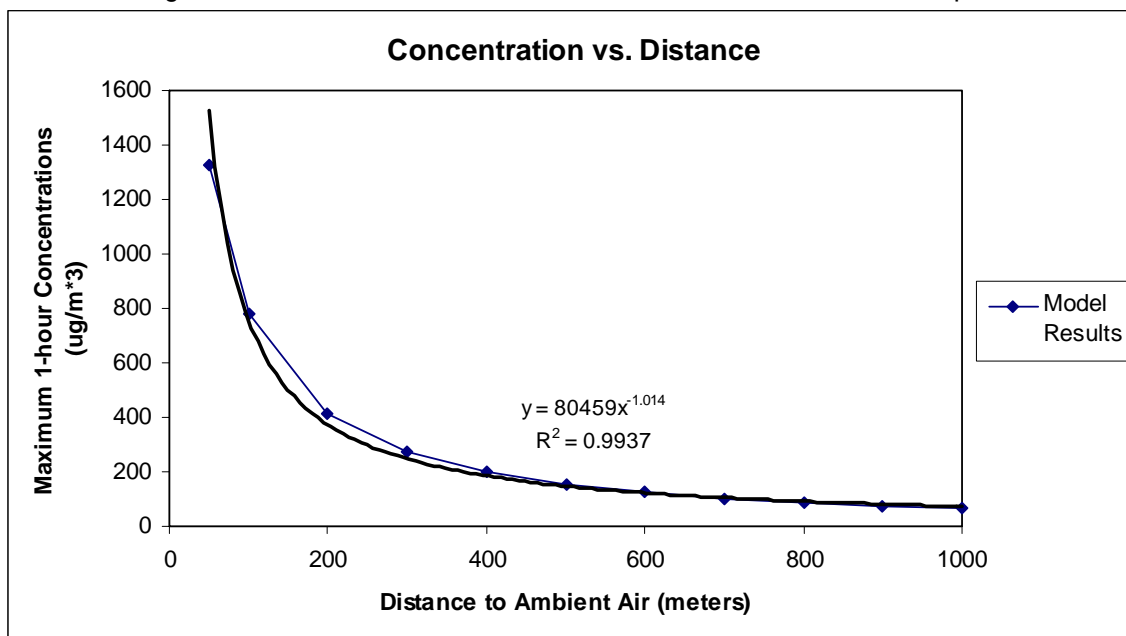
A stack diameter of one foot was used based on typical wall vent dimensions. A stack gas exit velocity of zero feet per second was used because a majority of welding units are vented through horizontal wall vents along the sides of the building(s) in which they are located. Horizontal stacks are modeled with zero velocity to eliminate momentum-induced plume rise. Both the stack gas and ambient temperatures were set to 70 degrees Fahrenheit in order to eliminate any buoyancy-induced plume rise.

The terrain was assumed to be flat and rural dispersion coefficients were used, based on the average land use and topography of Iowa. Receptors were placed at 50 meters, 100 meters, and every 100 meters beyond that out to one kilometer. The full meteorology screening grid was used in order to capture the absolute maximum concentration.

Modeling Analysis

The model was executed a total of 51 times, once for each stack height between 0 and 50 feet. The results from each run were imported into a spreadsheet and the maximum 1-hour concentration from all of them was determined for each receptor location, including the cavity concentration if applicable. The results were plotted on a graph, and the relationship between receptor location and maximum concentration was derived in the form of an equation (see Figure ee-1 below).

Figure ee-1. Maximum Predicted Concentration vs. Distance to Receptor.



The statistical correlation between the best-fit equation and the predicted values is very good, and can be used to derive what the model may have predicted at receptors spaced between those actually used in the modeling analysis. However, because the limit of the equation as x approaches zero is infinity, the equation would result in gross over-estimates of the predicted concentrations given very small distances to the property line. Additionally, the absolute maximum value predicted by the model at any location occurred at 50 meters away from the source with a stack height of 25 feet ($1326 \mu\text{g}/\text{m}^3$). Because the absolute maximum possible concentration is known, an upper bound can be set on the equation equal to this maximum value. Therefore, if the equation results in a value greater than 1326, then 1326 will be substituted in place of the equation's result. The concentrations predicted from this process were converted into 24-hour and annual averages by applying the conventional screening ratios of 0.40 and 0.08 respectively to the 1-hour average concentrations provided by the model (screening ratios are from EPA's Screening Procedures Manual). These values were then compared directly to the National Ambient Air Quality Standards (NAAQS). The results indicate that the emissions will cause multiple exceedances of both the 24-hour and annual PM_{10} NAAQS at distances out to 300 meters. Therefore, the nominal emission rate of 1 lb/hr that was used in the analysis is not an acceptable limit to include in the exemption. This is shown in Table ee-2.

The emission rate used in the modeling analysis (1 lb/hr) was prorated in order to determine the emission rate that would be required for predicted compliance with the PM_{10} NAAQS at each of the distances summarized in Table ee-2. This was accomplished using the following equation:

$$\frac{\text{Required Emission Rate (lb/hr)}}{\text{Modeled Emission Rate (lb/hr)}} = \frac{\text{NAAQS } (\mu\text{g/m}^3)}{\text{Model Result } (\mu\text{g/m}^3)}$$

Table ee-2. Predicted Results as Calculated by the Best-Fit Equation.

Distance to Receptor		Equation Result	Maximum Possible	Resulting 1-hour Conc.	Equivalent 24-hour Conc.	24-hour NAAQS	Equivalent Annual Conc.	Annual NAAQS
(m)	(ft)	($\mu\text{g/m}^3$)	($\mu\text{g/m}^3$)	($\mu\text{g/m}^3$)	($\mu\text{g/m}^3$)	($\mu\text{g/m}^3$)*	($\mu\text{g/m}^3$)	($\mu\text{g/m}^3$)*
50	164	1523.418	1326	1326	530.4	98	106.08	24
75	246	1009.863	1326	1009.863	403.9452	98	80.78905	24
100	328	754.353	1326	754.353	301.7412	98	60.34824	24
125	410	601.6001	1326	601.6001	240.64	98	48.12801	24
150	492	500.0554	1326	500.0554	200.0221	98	40.00443	24
175	574	427.6949	1326	427.6949	171.078	98	34.21559	24
200	656	373.5341	1326	373.5341	149.4136	98	29.88273	24
225	738	331.4832	1326	331.4832	132.5933	98	26.51866	24
250	820	297.8952	1326	297.8952	119.1581	98	23.83161	24
275	902	270.4527	1326	270.4527	108.1811	98	21.63621	24
300	984	247.6131	1326	247.6131	99.04525	98	19.80905	24
325	1066	228.31	1326	228.31	91.32399	98	18.2648	24
350	1148	211.7823	1326	211.7823	84.71291	98	16.94258	24
375	1230	197.4726	1326	197.4726	78.98905	98	15.79781	24
400	1312	184.9634	1326	184.9634	73.98536	98	14.79707	24
425	1394	173.9355	1326	173.9355	69.5742	98	13.91484	24
450	1476	164.141	1326	164.141	65.65641	98	13.13128	24
475	1558	155.3844	1326	155.3844	62.15375	98	12.43075	24
500	1640	147.5092	1326	147.5092	59.00367	98	11.80073	24
525	1722	140.389	1326	140.389	56.1556	98	11.23112	24
550	1804	133.9204	1326	133.9204	53.56818	98	10.71364	24
575	1886	128.0181	1326	128.0181	51.20725	98	10.24145	24
600	1968	122.611	1326	122.611	49.04438	98	9.808876	24
625	2050	117.6393	1326	117.6393	47.0557	98	9.411141	24
650	2132	113.0526	1326	113.0526	45.22103	98	9.044207	24
675	2214	108.8079	1326	108.8079	43.52318	98	8.704636	24
700	2296	104.8685	1326	104.8685	41.94742	98	8.389483	24
725	2378	101.2027	1326	101.2027	40.48106	98	8.096212	24
750	2460	97.78281	1326	97.78281	39.11312	98	7.822625	24
775	2542	94.58509	1326	94.58509	37.83404	98	7.566808	24
800	2624	91.58859	1326	91.58859	36.63544	98	7.327087	24
850	2788	86.1279	1326	86.1279	34.45116	98	6.890232	24
900	2952	81.27795	1326	81.27795	32.51118	98	6.502236	24
950	3116	76.9419	1326	76.9419	30.77676	98	6.155352	24
1000	3280	73.04233	1326	73.04233	29.21693	98	5.843387	24

* The 24-hour and Annual PM₁₀ NAAQS are 150 $\mu\text{g/m}^3$ and 50 $\mu\text{g/m}^3$ respectively. The values shown here are the NAAQS minus the current 24-hour and annual PM₁₀ background values of 52 $\mu\text{g/m}^3$ and 26 $\mu\text{g/m}^3$ respectively.

The required emission rate for each distance was determined for both the 24-hour NAAQS and the Annual NAAQS. The lesser of these two emission rates represent the

maximum emission rate that could be allowed for any source, given any combination of stack parameters, at a given separation distance between the source and nearest receptor. These emission rates are summarized in Table ee-3 below.

Table ee-3. Maximum Emission Rate Allowed for Welding Sources.

Distance to Receptor		24-hour Conc.	24-hour NAAQS	Required Emission Rate	Annual Conc.	Annual NAAQS	Required Emission Rate	Minimum Required Emission Rate	
(m)	(ft)	($\mu\text{g}/\text{m}^3$)	($\mu\text{g}/\text{m}^3$)	(lb/hr)	($\mu\text{g}/\text{m}^3$)	($\mu\text{g}/\text{m}^3$)	(lb/hr)	(lb/hr)	(ton/yr)
50	164	530.4	98	0.18	106.08	24	0.23	0.18	0.81
75	246	403.9452	98	0.24	80.78905	24	0.30	0.24	1.06
100	328	301.7412	98	0.32	60.34824	24	0.40	0.32	1.42
125	410	240.64	98	0.41	48.12801	24	0.50	0.41	1.78
150	492	200.0221	98	0.49	40.00443	24	0.60	0.49	2.15
175	574	171.078	98	0.57	34.21559	24	0.70	0.57	2.51
200	656	149.4136	98	0.66	29.88273	24	0.80	0.66	2.87
225	738	132.5933	98	0.74	26.51866	24	0.91	0.74	3.24
250	820	119.1581	98	0.82	23.83161	24	1.01	0.82	3.60
275	902	108.1811	98	0.91	21.63621	24	1.11	0.91	3.97
300	984	99.04525	98	0.99	19.80905	24	1.21	0.99	4.33
325	1066	91.32399	98	1.07	18.2648	24	1.31	1.07	4.70
350	1148	84.71291	98	1.16	16.94258	24	1.42	1.16	5.07
375	1230	78.98905	98	1.24	15.79781	24	1.52	1.24	5.43
400	1312	73.98536	98	1.32	14.79707	24	1.62	1.32	5.80
425	1394	69.5742	98	1.41	13.91484	24	1.72	1.41	6.17
450	1476	65.65641	98	1.49	13.13128	24	1.83	1.49	6.54
475	1558	62.15375	98	1.58	12.43075	24	1.93	1.58	6.91
500	1640	59.00367	98	1.66	11.80073	24	2.03	1.66	7.27
525	1722	56.1556	98	1.75	11.23112	24	2.14	1.75	7.64
550	1804	53.56818	98	1.83	10.71364	24	2.24	1.83	8.01
575	1886	51.20725	98	1.91	10.24145	24	2.34	1.91	8.38
600	1968	49.04438	98	2.00	9.808876	24	2.45	2.00	8.75
625	2050	47.0557	98	2.08	9.411141	24	2.55	2.08	9.12
650	2132	45.22103	98	2.17	9.044207	24	2.65	2.17	9.49
675	2214	43.52318	98	2.25	8.704636	24	2.76	2.25	9.86
700	2296	41.94742	98	2.34	8.389483	24	2.86	2.34	10.23
725	2378	40.48106	98	2.42	8.096212	24	2.96	2.42	10.60
750	2460	39.11312	98	2.51	7.822625	24	3.07	2.51	10.97
775	2542	37.83404	98	2.59	7.566808	24	3.17	2.59	11.35
800	2624	36.63544	98	2.68	7.327087	24	3.28	2.68	11.72
850	2788	34.45116	98	2.84	6.890232	24	3.48	2.84	12.46
900	2952	32.51118	98	3.01	6.502236	24	3.69	3.01	13.20
950	3116	30.77676	98	3.18	6.155352	24	3.90	3.18	13.95
1000	3280	29.21693	98	3.35	5.843387	24	4.11	3.35	14.69

The emission rates shown in Table ee-3 indicate that there may be greater flexibility if the exemption included a provision for the separation distance between welding sources and ambient air. The emission rates were translated into annual electrode usage (in pounds of electrode per year) using the maximum AP-42 emission factors for the classification(s) of electrode(s) that are

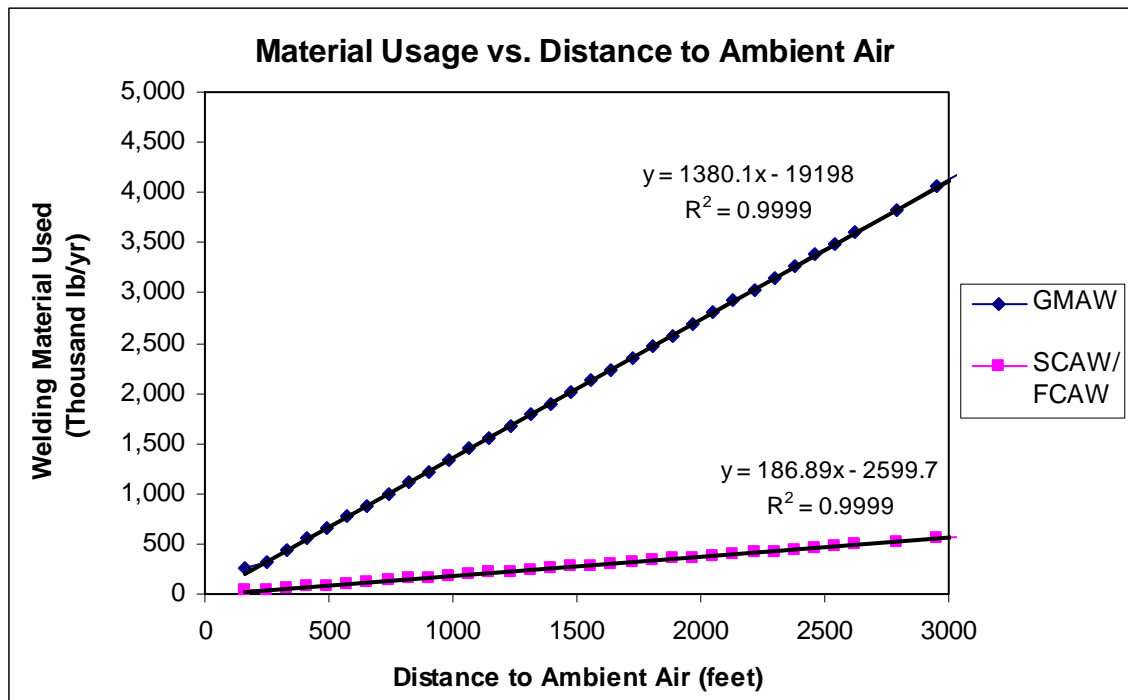
to be included in the exemption. An additional 25% was added to the emission factors as a safety measure, resulting in emission factors of 48 lb of PM₁₀ per 1000 lb of electrode for SMAW and FCAW-type sources, and 6.5 lb of PM₁₀ per 1000 lb of electrode for GMAW-type sources. These electrode usage limits equate to an amount of material that could be used in a year without causing any exceedances of the PM₁₀ NAAQS given the conservative assumptions made earlier in this analysis. The results can be seen in Table ee-4 below.

Table ee-4. Maximum Electrode Usage Allowed for Welding Source.

Distance to Receptor		Minimum Required Emission Rate		Maximum Electrode Usage for SMAW and FCAW Sources	Maximum Electrode Usage for GMAW Sources
(m)	(ft)	(lb/hr)	(ton/yr)	(lb/yr)	(lb/yr)
50	164	0.18	0.81	33,720	249,008
75	246	0.24	1.06	44,276	326,960
100	328	0.32	1.42	59,273	437,706
125	410	0.41	1.78	74,323	548,844
150	492	0.49	2.15	89,415	660,296
175	574	0.57	2.51	104,543	772,010
200	656	0.66	2.87	119,701	883,948
225	738	0.74	3.24	134,886	996,082
250	820	0.82	3.60	150,095	1,108,392
275	902	0.91	3.97	165,325	1,220,859
300	984	0.99	4.33	180,574	1,333,470
325	1066	1.07	4.70	195,841	1,446,212
350	1148	1.16	5.07	211,125	1,559,076
375	1230	1.24	5.43	226,424	1,672,052
400	1312	1.32	5.80	241,737	1,785,135
425	1394	1.41	6.17	257,064	1,898,316
450	1476	1.49	6.54	272,403	2,011,591
475	1558	1.58	6.91	287,754	2,124,954
500	1640	1.66	7.27	303,117	2,238,400
525	1722	1.75	7.64	318,490	2,351,926
550	1804	1.83	8.01	333,874	2,465,528
575	1886	1.91	8.38	349,267	2,579,202
600	1968	2.00	8.75	364,670	2,692,946
625	2050	2.08	9.12	380,081	2,806,755
650	2132	2.17	9.49	395,502	2,920,629
675	2214	2.25	9.86	410,930	3,034,563
700	2296	2.34	10.23	426,367	3,148,557
725	2378	2.42	10.60	441,812	3,262,608
750	2460	2.51	10.97	457,263	3,376,714
775	2542	2.59	11.35	472,722	3,490,874
800	2624	2.68	11.72	488,189	3,605,085
850	2788	2.84	12.46	519,141	3,833,655
900	2952	3.01	13.20	550,118	4,062,413
950	3116	3.18	13.95	581,120	4,291,350
1000	3280	3.35	14.69	612,145	4,520,456

The results were plotted on a graph, and the relationship between receptor location and maximum allowable annual electrode usage was derived in the form of two equations (see Figure ee-2 below).

Figure ee-2. Maximum Allowable Annual Electrode Usage vs. Distance to Receptor.



There is a perfect linear statistical correlation between the amount of electrode that can be used annually and the distance from the welding source(s) to ambient air. It is necessary to include two separate equations due to the fact that the SMAW and FCAW sources emit at a much higher rate than the GMAW sources. Limiting all welding to the worse case emissions of the SMAW and FCAW sources would be unnecessarily burdensome for those facilities that use the GMAW type of source. The equations for each type of welding are:

SMAW/FCAW

$$y = 187x - 2600$$

GMAW

$$y = 1380x - 19200$$

Where:

x = the minimum distance between any welding unit and ambient air in feet.

y = the amount of electrode in lb/yr that would be covered under the exemption.

Please note that these equations are only beneficial for facilities whose property line is at least 50 meters (164 feet) away from the nearest welding unit. If a distance less than 164 feet is input into either equation, the resulting electrode usage would be less than is allowed by the very worst case scenario in the initial modeling. The worst case concentration was predicted to occur 50 meters from the source. If each equation is applied to this worst case condition, the result is 28,000 lb/yr (rounded down from 28,068 for simplicity) for the SMAW and FCAW-type sources, and 200,000 lb/yr (rounded down from 207,120 for simplicity) for the GMAW-type sources. Therefore, any facility that uses a total amount of electrode per year that is less than these values would never be predicted to cause an exceedance of the PM₁₀ NAAQS. Because of this, these values can be considered thresholds under which a facility would not need to use the equations in order to be exempt, regardless of the distance to their property line. Also, if when using the equations, the resulting electrode usage is less than the appropriate threshold, the threshold value should be used instead of the equation's result. For simplicity's sake, if a facility operates both types of welding units, they would simply use the threshold and equation for the SMAW and FCAW-type for all welding emissions from their facility that are to be exempted. Doing so is conservative and avoids confusion. A brief summary of the equation results as compared to the model-predicted allowable electrode usage values are shown in Table ee-5 below.

Table ee-5. Comparison of Model and Equation/Threshold Predictions of Electrode Usage.

Distance to Receptor		Maximum Electrode Usage for SMAW and FCAW Sources as Predicted by the...		Maximum Electrode Usage for GMAW Sources as Predicted by the...	
		Model	Equation and Threshold	Model	Equation and Threshold
(m)	(ft)	(lb/yr)	(lb/yr)	(lb/yr)	(lb/yr)
25	82	33,720	28,000*	249,008	200,000*
50	164	33,720	28,068	249,008	207,120
75	246	44,276	43,402	326,960	320,280
100	328	59,273	58,736	437,706	433,440
200	656	119,701	120,072	883,948	886,080
300	984	180,574	181,408	1,333,470	1,338,720
400	1312	241,737	242,744	1,785,135	1,791,360
500	1640	303,117	304,080	2,238,400	2,244,000
600	1968	364,670	365,416	2,692,946	2,696,640
700	2296	426,367	426,752	3,148,557	3,149,280
800	2624	488,189	488,088	3,605,085	3,601,920
900	2952	550,118	549,424	4,062,413	4,054,560
1000	3280	612,145	610,760	4,520,456	4,507,200

* For distances less than 164 feet the equation results in values that are less than the thresholds established by the modeling. Therefore, the threshold values are substituted in these cases.

Conclusion

This modeling analysis represents a very conservative scenario in which all welding emissions from an entire facility are vented through a single emission point. The source parameters were chosen in such a fashion that the worst case impacts were predicted.

The stack gas was assumed to have no initial buoyancy or momentum, resulting in a lowered plume centerline. The stack height was varied between ground level and GEP, and building downwash was considered, including the cavity concentration. The worse case impacts for each receptor location were utilized in the final analysis regardless of the combination of parameters that caused them.

Annual electrode usage thresholds were derived, as were equations that may be used to allow for additional electrode usage for facilities whose emissions occur a significant distance from ambient air. The thresholds and equations that are being recommended are summarized in Table ee-6. This analysis justifies the use of these threshold values and associated equations in the proposed welding exemption.

Table ee-6. Summary of Analysis Results

Type of Welding*	Level of Electrode Usage that is Exempt	
	Independent of Distance to Ambient Air	Dependant on Distance to Ambient Air
SMAW and FCAW	28,000 lb/year	$y = 187x - 2600$
GMAW	200,000 lb/year	$y = 1380x - 19200$

* If both types of welding are present at a facility, the threshold and/or equation for SMAW and FCAW should be used.

ff. Electric hand soldering, wave soldering, and electric solder paste reflow ovens.

A general exemption for soldering activities based on the recognition that the potential emissions associated to such activities are inherently limited.

Solder Constituents- Potential for Lead and Other Metal HAP Emissions

Tin & Lead is the most common solder constituent utilized in manufacturing activities. Other solders to a lesser degree can contain metals including: silver, copper, nickel, indium, zinc and bismuth. The composition of tin/lead solder may vary but is commonly 60-63% tin and 37-40% lead. The physical properties of lead are represented below:

Lead Melting Point = 621 °F

Boiling Point = 3164 °F

Vapor Pressure = 0.0 mm Hg

All solder mixtures have a melting point below 450 °F. Tin lead solder has the lowest melting point of 361°F. All solders mixtures provide a wide temperature separation between the melting point and boiling point (vaporization point) of all toxic metals. Excessive amount metal fumes will not be emitted unless the solder is heated to extreme temperatures. The following represents the normal operating temperature for common soldering activities which minimize the potential to release toxic emissions.

- **Electric Hand Soldering:** Electric soldering iron temperatures typically operate at a tip temperature between 620°F - 700°F. Currently there are no emission factors available for this activity.
- **Wave Soldering:** The molten solder of a wave solder machine operates at an approximate temperature of 500 °F. The School of Public Health at the University of Illinois measured an average of 86 mg/hr for uncontrolled lead emissions from three wave soldering lines. This calculates to a minimal 1.66 lbs/yr based on 8760 hrs of operation. For Section 313 (Form R) reporting this is the only EPA accepted emission factor for soldering activity. In the absence of emission factors all other soldering activities are not required to report lead air emissions.
- **Solder Paste Reflow Ovens:** This activity involves applying small quantities of solder paste (fraction of a gram) to circuit boards to attach components. The board is run through an oven with an operating air temperature of 500 degrees. Currently there are no emission factors available for this activity.

Limited Potential VOC Emission Associated to Soldering Activities

Small quantities of fluxes and rosins are applied to help the solder flow more evenly. When this material is heated it may release VOC emissions. The amount of material applied varies with the soldering method, material throughput and/or operational capacity of the soldering unit. The VOC emissions resulting from the flux/rosin utilized in a soldering operation is inherently limited. The assertion is that the PTE VOC emissions associated to all individual soldering operations is clearly below the 3.75 ton threshold as specified in the small source exemption (567 IAC 22.1(2)“w”).

- **Hand Soldering utilizing flux core solder wire and/or paste reflow operations:**
 - Assumption: Maximum volatile flux content within solder product =10% by weight.
 - Would require the operational throughput of 37.50 tons of solder wire or paste to exceed small unit threshold for VOC. This would be an unreasonable throughput expectation.
- **Wave Soldering:** Wave solder machine applies a thin film of flux to the bottom side of the board prior to contacting the solder wave. The flux is comprised mainly of isopropanol. The typical unit operating 24 hrs per day will consume less than 10 gallons of flux per week or 520 gallons per year. Periodically other solvents (finger cleaners) may be applied to a the machine for cleaning purposes
 - Assumption: Liquid Flux = 7.34 lb/gal
 - A wave soldering unit would need to use in excess of 1022 gallons of flux per year to exceed the small unit threshold for VOC. This would be an unreasonable throughput expectation.

gg. Pressurized piping and storage systems for natural gas, propane, liquefied petroleum gas (LPG), and refrigerants. Pressurized piping and storage systems are closed systems that do not have emissions under normal operating conditions. Additionally, natural gas,

propane, and LPG storage systems are considered insignificant activities under the Title V regulations, 567 IAC 22.103(1)w.”

hh. Emissions from the storage and mixing of paints, solvents or flammable materials provided the emissions from the storage and mixing are accounted for in an enforceable permit condition or are otherwise exempt. Emissions from flammable storage and mixing areas that are accounted for in a federally enforceable limit should be exempt from construction permitting since they have already undergone an evaluation by the department to determine regulatory applicability and ambient impact. Therefore, additional review of these emissions would not provide any additional environmental protection.